

ABSTRACT OF THE DISCLOSURE

A new transparent conducting oxide (TCO), which can be expressed as $\text{Al}_x\text{Ga}_{3-x}\text{In}_{5+y}\text{Sn}_{2-z}\text{O}_{16-2z}$; $0 \leq x < 1$, $0 < y < 3$, $0 \leq z < 2$, has been used to improve
5 the brightness and current spreading in GaN base LED process. The optical properties of this system are superior to regular Ni/Au transparent conducting layer in blue-green region, and the new $\text{Al}_2\text{O}_3\text{-Ga}_2\text{O}_3\text{-In}_2\text{O}_3\text{-SnO}_2$ system is able to increase the brightness at 1.5~2.5 time to compare to regular process. Furthermore, the new transparent conducting oxide thin
10 film has the highest conductivity, which is better than the Ni/Au transparent conducting thin film.

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